

TABLE VII.—Heights of rivers referred to zeros of gages.—Continued.

| Stations. | Distance to mouth of river. | Danger line on gage. | Highest water. | | Lowest water. | | Mean stage. | Monthly range. | Stations. | Distance to mouth of river. | Danger line on gage. | Highest water. | | Lowest water. | | Mean stage. | Monthly range. |
|-----------------------------------|-----------------------------|----------------------|----------------|-------|---------------|-------|--------------|----------------|---------------------------------|-----------------------------|----------------------|----------------|-------|---------------|-------|--------------|----------------|
| | | | Height. | Date. | Height. | Date. | | | | | | Height. | Date. | Height. | Date. | | |
| <i>Columbia River</i> | <i>Miles.</i> | <i>Feet.</i> | <i>Feet.</i> | | <i>Feet.</i> | | <i>Feet.</i> | <i>Feet.</i> | <i>Willamette River—Cont'd.</i> | <i>Miles.</i> | <i>Feet.</i> | <i>Feet.</i> | | <i>Feet.</i> | | <i>Feet.</i> | <i>Feet.</i> |
| Umatilla, Oreg..... | 270 | 25 | 5.9 | 28 | 1.0 | 9 | 2.2 | 4.9 | Portland, Oreg..... | 12 | 15 | 13.0 | 18.19 | 3.5 | 9.10 | 8.2 | 9.5 |
| The Dalles, Oreg..... | 166 | 40 | 9.8 | 28 | 2.2 | 12 | 4.2 | 7.6 | <i>Sacramento River.</i> | | | | | | | | |
| <i>Willamette River.</i> | | | | | | | | | Red Bluff, Cal..... | 265 | 23 | 28.2 | 16 | 3.4 | 1-4 | 12.0 | 24.8 |
| Albany, Oreg. ¹² | 118 | 20 | 24.7 | 17 | 4.9 | 5 | 11.6 | 18.8 | Sacramento, Cal..... | 64 | 25 | 27.9 | 26 | 12.8 | 4 | 19.2 | 15.1 |

¹ Frozen entire month. ² Frozen for 15 days. ³ 28 days only. ⁴ Gorged for 12 days. ⁵ Frozen for 17 days. ⁶ Frozen for 4 days. ⁷ Frozen for 14 days. ⁸ Frozen for 25 days. ⁹ Frozen for 11 days. ¹⁰ Frozen for 12 days. ¹¹ Frozen for 1 day. ¹² Gage broken. ¹³ Record incomplete.

HAWAIIAN CLIMATOLOGICAL DATA.

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Rainfall data for February, 1904.

| Stations. | Elevation. | Amount. | Stations. | Elevation. | Amount. |
|------------------------------|--------------|----------------|---------------------------------|--------------|----------------|
| HAWAII. | | | MAUI—Continued. | | |
| Hilo, e. and ne. | <i>Feet.</i> | <i>Inches.</i> | Paia. | <i>Feet.</i> | <i>Inches.</i> |
| Waialea | 50 | 11.17 | Haleakala Ranch. | 2,000 | 15.72 |
| Hilo (town). | 85 | 11.17 | Wailuku, ne. | 250 | 20.50 |
| Paueo | 1,250 | | LANAI. | | |
| Kaunama | 100 | 8.50 | Keomuku | 10 | 19.73 |
| Pepeekeo | 200 | 8.79 | OAHU. | | |
| Hakalau | 300 | 9.21 | Punahou (W. B.), sw. | 47 | 24.90 |
| Puuhoua | 1,050 | 12.63 | Kulaokahua (Castle), sw. | 50 | 24.93 |
| Laupahoehoe | 500 | 7.80 | Makiki Reservoir | 120 | 29.65 |
| Ookala | 400 | | U. S. Naval Station, sw. | 6 | 14.55 |
| HAMAKUA, ne. | | | Kapiolani Park, sw. | 10 | 22.72 |
| Kukui | 250 | 9.86 | College Hills. | 175 | 25.27 |
| Paauilo | 300 | 10.28 | Manoa (Woodlawn Dairy), c. | 285 | 27.83 |
| Paauhau | 300 | 7.85 | Manoa (Rhodes Gardens) | 360 | 31.11 |
| Honokaa (Mill) | 425 | 8.82 | Insane Asylum. | 30 | 23.15 |
| Honokaa (Meinicke) | 1,100 | | School street (Bishop), sw. | | |
| Kukuihaele | 700 | 9.00 | Kamehameha School. | | |
| KOHALA, n. | | | Kalihi-Uka, sw. | 485 | 30.30 |
| Awini Ranch | 1,100 | 13.40 | Nuuanu (W. W. Hall), sw. | 50 | 25.08 |
| Halawa | 450 | 14.05 | Nuuanu (Wylie street). | 250 | 24.23 |
| Niuli | 200 | 14.26 | Nuuanu (Elec. Station), sw. | 405 | 22.51 |
| Kohala (Mission) | 521 | 13.62 | Nuuanu (Luakaha), c. | 850 | 27.96 |
| Kohala (Sugar Co.) | 270 | 13.24 | U. S. Experiment Station. | 350 | 29.97 |
| Hawi Mill | 700 | | Kaliula | 1,150 | |
| Puakea Ranch | 600 | 12.02 | Laniakaa (Nahuina) | | |
| Puuhue Ranch. | 1,847 | 14.25 | Tantalus Heights (Frear) | 1,360 | 30.76 |
| Waimea | 2,720 | 9.68 | Waimanalo, ne. | 25 | 41.03 |
| KONA, w. | | | Maunawili, ne. | 300 | 44.65 |
| Huehue | 2,000 | 13.32 | Kaneohe | 100 | 26.28 |
| Holualoa | 1,350 | 16.51 | Abuimani, ne. | 350 | 38.09 |
| Kauakohu Leheula | 3,500 | 17.99 | Kahuku, n. | 25 | 38.82 |
| Kainaliu | 1,470 | 14.25 | Waiialua | | |
| Kealakekua | 1,580 | 16.30 | Ewa Plantation, s. | 900 | 33.34 |
| Napoopoo | 1,650 | 15.15 | U. S. Magnetic Station | 60 | 25.21 |
| Hoopuloa | 1,200 | 7.29 | Waipahu | 200 | 30.04 |
| Hoopuloa | 1,200 | 10.00 | Moanalua | 15 | 20.12 |
| Puuwaawaa Ranch. | 2,700 | 27.00 | Pacific Heights. | | |
| Huehue | | | KAUAI. | | |
| KATU, se. | | | Lihue (Grove Farm), e. | 200 | 22.38 |
| Kahuku Ranch. | 1,680 | | Lihue (Mokoko), e. | 300 | 21.37 |
| Honouapo | 15 | 13.75 | Lihue (Kukua), e. | 1,000 | 25.46 |
| Naalehu | 650 | 13.91 | Lihue (Kilohana) | 400 | 22.16 |
| Hilea | 310 | 12.40 | Kealia, e. | 15 | 21.43 |
| Pahala | 850 | | Kilauea (Plantation), ne. | 325 | |
| Moaula | | | Hanalei, n. | 10 | 15.22 |
| Volcano House. | 4,000 | 17.27 | Waioli | | |
| PUNA, e. | | | Haena | | |
| Olaa, Mountain View (Russel) | 1,530 | 11.17 | Waiawa | | |
| Olaa Plantation (Mill) | 210 | 14.45 | Eleele | 150 | |
| Kapoho | 110 | 20.40 | Wahiawa (Mountain) | 3,000 | |
| Pahoa | 600 | 18.32 | McBryde (Residence) | 850 | |
| MAUI. | | | Lawai (Gov. Road) | 450 | |
| Labaina. | | | Lawai, w. | 225 | |
| Waiopae Ranch | 700 | 17.58 | Koloa | 800 | |
| Kaupo (Mokulau), s. | 285 | 25.37 | Lawai | 100 | |
| Kipahulu, s. | 308 | 23.87 | Lawai Beach | | |
| Hana. | | | | | |
| Nahiku, ne. | 850 | 15.52 | Delayed January reports. | | |
| Nahiku | 1,600 | 18.09 | U. S. Magnetic Station | | 0.95 |
| Haiku, n. | 700 | 12.73 | Kahuku | | 1.94 |
| Kula (Erehwon), n. | 4,500 | 21.45 | Hoopuloa | | 1,650 |
| Kula (Waiakoa), n. | 2,700 | 15.59 | Hoopuloa | | 5.96 |
| Puunamalei, n. | 1,400 | 13.00 | Puuwaawaa Ranch | | 1.95 |
| | | | Paia plantation | | 9.29 |

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

GENERAL SUMMARY FOR FEBRUARY, 1904.

Honolulu.—Temperature mean for the month, 70.1°; normal, 70.2°; average daily maximum, 75.2°; average daily minimum, 65.2°; mean daily range, 10°; greatest daily range, 18° (4th); least daily range, 4° (17th); highest temperature, 79° (29th); lowest temperature, 55° (4th).

Barometer average, 29.892; normal, 29.966; highest, 30.07

Meteorological Observations at Honolulu, February, 1904.

The station is at 21° 18' north, 157° 50' west. It is the Hawaiian Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.) Hawaiian standard time is 10° 30' slow of Greenwich time. Honolulu local mean time is 19° 31' slow of Greenwich.

The pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

Rainfall for twenty-four hours is measured at 9 a. m. local, or 7:31 p. m., Greenwich time. The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet and the barometer 50 feet above sea level.

| Date. | Pressure at sea level. | | Temperature. | | During twenty-four hours preceding 1 p. m. Greenwich time, or 2:30 a. m. Honolulu time. | | | | | | | | | | Total rainfall at 9 a. m., local time. |
|------------|------------------------|-----------|--------------|----------|---|--------------------|-----------------------|----------|--------|---------------------|----------------------|--------|-------|--|--|
| | Dry bulb. | Wet bulb. | Temperature. | | Means. | | Wind. | | Force. | Average cloudiness. | Sea-level pressures. | | | | |
| | | | Maximum. | Minimum. | Dew-point. | Relative humidity. | Prevailing direction. | Maximum. | | | Minimum. | | | | |
| 1..... | 29.95 | 67 | 60 | 74 | 63 | 61.7 | 81 | sw.-ne. | 3 | 8-3 | 29.99 | 29.91 | 0.04 | | |
| 2..... | 30.00 | 68 | 63 | 74 | 66 | 57.3 | 66 | ne. | 4 | 1 | 30.02 | 29.96 | 0.00 | | |
| 3..... | 29.95 | 57 | 55 | 73 | 63 | 58.0 | 73 | ne. | 2 | 0 | 30.03 | 29.95 | 0.00 | | |
| 4..... | 29.90 | 56 | 54 | 73 | 57 | 56.0 | 77 | ne. | 2 | 0 | 29.98 | 29.89 | 0.00 | | |
| 5..... | 29.98 | 63 | 61 | 73 | 55 | 54.0 | 73 | sw. | 1 | 0 | 29.95 | 29.89 | 0.00 | | |
| 6..... | 29.89 | 69 | 65 | 76 | 60 | 59.0 | 74 | sw. | 0 | 1 | 30.03 | 29.94 | 0.01 | | |
| 7..... | 29.88 | 63 | 62 | 76 | 65 | 66.0 | 87 | se. | 0 | 3 | 29.96 | 29.88 | 0.01 | | |
| 8..... | 29.89 | 66 | 65 | 71 | 63 | 63.7 | 95 | z. | 1 | 0 | 29.96 | 29.86 | 0.25 | | |
| 9..... | 29.92 | 70 | 68 | 73 | 65 | 66.3 | 93 | z. | 0 | 1 | 29.96 | 29.86 | 1.32 | | |
| 10..... | 29.83 | 67 | 65 | 76 | 67 | 68.7 | 91 | z. | 1 | 0 | 29.93 | 29.82 | 0.40 | | |
| 11..... | 29.67 | 66 | 65 | 74 | 65 | 66.5 | 93 | se. | 2 | 0 | 29.83 | 29.68 | 2.30 | | |
| 12..... | 29.62 | 68 | 66.5 | 75 | 65 | 67.5 | 90 | z.-sw. | 2 | 0 | 29.70 | 29.59 | 7.51 | | |
| 13..... | 29.73 | 68 | 66 | 77 | 68 | 67.0 | 87 | sw. | 2 | 0 | 29.73 | 29.62 | 0.26 | | |
| 14..... | 29.73 | 71 | 70 | 76 | 68 | 67.3 | 85 | sw. | 1 | 0 | 29.79 | 29.73 | 0.10 | | |
| 15..... | 29.84 | 69 | 68 | 74 | 69 | 67.5 | 94 | sw. | 1 | 0 | 29.90 | 29.81 | 0.52 | | |
| 16..... | 29.92 | 71 | 70.5 | 75 | 65 | 69.7 | 96 | z. | 0 | 10 | 29.96 | 29.82 | 1.43 | | |
| 17..... | 29.85 | 72 | 71 | 75 | 66 | 71.3 | 94 | z. | 0 | 10 | 29.95 | 29.86 | 1.09 | | |
| 18..... | 29.89 | 69 | 65.5 | 75 | 71 | 70.0 | 93 | z. | 0 | 10 | 29.91 | 29.81 | 0.20 | | |
| 19..... | 29.80 | 74 | 72 | 77 | 65 | 66.7 | 84 | se.-s. | 3 | 0 | 29.89 | 29.75 | 0.78 | | |
| 20..... | 29.89 | 68 | 67.5 | 75 | 67 | 68.3 | 92 | z.-sw. | 1 | 0 | 29.93 | 29.78 | 0.72 | | |
| 21..... | 29.99 | 63 | 61.5 | 76 | 68 | 67.7 | 89 | sw. | 0 | 7 | 30.00 | 29.88 | 0.43 | | |
| 22..... | 30.02 | 67 | 65 | 76 | 62 | 63.3 | 77 | ne. | 1 | 4 | 30.06 | 29.95 | 0.00 | | |
| 23..... | 30.02 | 71 | 66 | 78 | 66 | 65.5 | 81 | ne. | 1 | 4 | 30.04 | 29.97 | 0.00 | | |
| 24..... | 30.01 | 70 | 65 | 78 | 71 | 63.3 | 72 | ne. | 1 | 4 | 30.07 | 30.00 | 0.00 | | |
| 25..... | 29.95 | 70 | 67 | 76 | 70 | 63.7 | 79 | ne.-e. | 2 | 0 | 30.04 | 29.97 | 0.00 | | |
| 26..... | 29.91 | 67 | 65 | 78 | 68 | 65.3 | 81 | ene. | 0 | 7 | 29.99 | 29.90 | 0.06 | | |
| 27..... | 29.89 | 65 | 64.5 | 78 | 65 | 66.7 | 82 | se.-s. | 0 | 5 | 29.95 | 29.87 | 0.00 | | |
| 28..... | 29.91 | 64 | 63 | 75 | 65 | 65.0 | 88 | z.-sw. | 0 | 10 | 29.95 | 29.86 | 1.50 | | |
| 29..... | 29.89 | 71 | 69 | 76 | 63 | 64.3 | 83 | sw. | 0 | 5 | 29.95 | 29.89 | 0.00 | | |
| 30..... | | | | | | | | | | | | | | | |
| 31..... | | | | | | | | | | | | | | | |
| Sums | | | | | | | | | | | | | 24.90 | | |
| Means | 29.887 | 67.2 | 65.1 | 75.2 | 65.2 | 64.7 | 84.5 | | 0.7 | 6.9 | 29.947 | 29.850 | | | |
| Departure. | —0.074 | | | | | +2.4 | +8.0 | | +2.1 | | | | | | |

Mean temperature for the month of February, 1904, (6 + 2 + 9) ÷ 3 = 70.1°; normal is 70.2°. Mean pressure for the month of February, 1904, (9 + 3) ÷ 2 = 29.892; normal is 29.966.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4:31 p. m., Greenwich time. ‡ These values are the means of (6 + 9 + 2 + 9) ÷ 4. § Beaufort scale.

Maximum thermometer set at 9 p. m. and minimum at 2 p. m., local time.

|| 10-4-10. ||| 8-10-4. |||| 19.39.

(23d); lowest, 29.59 (11th); greatest 24-hour change, that is from any given hour of one day to the same hour on the next, .15; lows passed this point 6th to 20th and 26th to 29th, inclusive; highs, 23d.

Relative humidity average, 84.5 per cent; normal, 76.5 per cent; mean dew-point, 64.7°; normal, 62.3°; mean absolute moisture, 6.78 grains per cubic foot; normal, 6.24 grains.

Rainfall, 24.90 inches; normal, 5.51 inches; greatest rainfall in twenty-four hours 7.51 inches (from 9 a. m., 10th to 9 a. m., 11th); rain record days, 19; normal, 12; heaviest rainfall for

Oahu, at Maunawili, 44.65 inches; least, 14.55 inches at United States Naval Station.

The artesian well water level rose from 33.93 to 34.80 feet above mean sea level. February 28, 1903, it stood at 35.25. The average daily mean sea level for the month was 9.88, the assumed annual mean being 10 feet above datum. For February, 1903, it was 9.66.

Trade wind days, 8 (2 nne.); normal, 15; average force of wind, Beaufort scale and during daylight only, 0.7; average cloudiness, tenths of sky, 6.9; normal, 4.8.

Approximate percentages of district rainfall as compared with normal: Hawaii, Hilo district, 103 per cent; Hamakua, 130; Kohala, 325; Waimea, 210; Kona, 290; Kau, 486; Puna, 200; island of Maui—variable from 279 at Puuomalei to 871 at Paia; Oahu, Honolulu district, 452; Nuuanu, 303; Koolau, 610; Ewa, 733; island of Kauai—Lihue district, 453; Hanalei 155; Waiawea, 487 per cent.

The heaviest monthly rainfall was at Maunawili, Oahu, 44.65 inches. The heaviest 24-hour rainfalls were at Maunawili, 12.50 (11th); Pahoa, Hawaii, 11.00 (12th); Kahuku, 10.69 (11th).

Kohala, dew-point, 63.5°; relative humidity, 79.7 per cent.

Ewa Mill—Mean pressure, 29.85.

The month was characterized by heavy rains, especially on the island of Oahu, where the record was broken; low pressure, the barometer being below the normal for the first time in eight months; also by high relative humidity, dew-point

and cloudiness, all of which were considerably above the normal. A marked feature of the storms was the light wind prevailing, the average force for the month being but 0.7 Beaufort scale.

Honolulu—Dew six mornings, and frequent thunder and lightning during the month.

Reported from other stations—Pepeekeo, Hawaii, dew twelve mornings; heavy surf 6th, 7th, 26th, and 27th; slight earthquake 19th at 1:05 a. m.; considerable thunder and lightning at intervals; snow on mountains all the month.

Waimea, Hawaii.—Lightning 1st and 4th to 9th, inclusive. Heavy thunder and lightning on 11th; generally cloudy weather; strong northwest gale 12th and 13th.

Hilo, Hawaii.—Earthquakes 14th at 1:33 p. m. (heavy), and 18th at 10:25 a. m.

Temperature table for February, 1904.

| Stations. | Elevation. | Mean max. | Mean min. | Cor. av'ge. | High-est. | Low-est. |
|--|--------------|-----------|-----------|-------------|-----------|----------|
| | <i>Feet.</i> | ° | ° | ° | ° | ° |
| Hilo | 40 | 79.7 | 66.0 | 72.2 | 85 | 60 |
| Pepeekeo | 100 | 76.2 | 66.3 | 70.6 | 80 | 62 |
| Olaa Mill | 210 | 82.9 | 60.9 | 71.2 | 89 | 58 |
| Kohala | 521 | 76.2 | 64.1 | 69.5 | 83 | 60 |
| Waimea | 2,730 | 73.2 | 57.0 | 64.4 | 80 | 48 |
| Volcano House | 4,000 | 68.5 | 50.9 | 59.0 | 73 | 47 |
| Waiakeo | 2,700 | 73.5 | 57.9 | 65.0 | 81 | 53 |
| Keomuku | 10 | 78.5 | 70.4 | 74.1 | | |
| Kinai | 50 | 74.3 | 66.9 | 69.9 | 79 | 53 |
| Ewa Plantation | | | | | | |
| United States Experiment Station | 350 | 76.3 | 64.6 | 70.2 | 82 | 57 |